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Abstract

Since the Seventies, increases in public debt and deficits have raised concern about their effects on interest rates. Growing public debt and persistent deficits would have led to inflation pressures, which would have forced central Banks to raise the short-term interest rate. Expectations of these pressures by financial markets would involve a rise in long-term interest rates and crowding-out effects. This paper studies the fiscal policy effects on interest rates from a theoretical and empirical point of view. Fiscal policy effects mainly depend on the full-employment hypothesis, the type of shocks affecting the economy, the type of fiscal policy, and agents' expectations about it. The estimated effects of fiscal policy variables in central Banks' reaction functions and long-term interest rate equations for the United States, the United Kingdom, Germany and Japan for the 1980-2003 period show that these effects are not *mechanical* and vary from one country to another. All in all, fiscal policies would not have entailed a generalized increase in real interest rates over that period.

Keywords: fiscal policy, interest rate, expectations, crowding-out effect

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Increases in deficits and public debt stocks since the Seventies have led economists to question their impact on interest rates. According to a widespread thesis, the worsening of public finances would have involved a rise in real rates, which would have discouraged firms to invest and households to consume. High levels of public debt and deficit would create inflationary pressures, which would lead central Banks to increase the short rate. Financial markets would expect these pressures to keep on, and so a high short rate, which would immediately trigger a higher level of long rates. In the long run, the equilibrium real interest rate, compatible with price stability, would then be a positive function of public debt and deficit levels. On the contrary, a cut in the level of public expenditures would have a positive impact on private demand, which would at least partially balance the negative effect of a fiscal retrenchment on activity. This thesis is thus part of the new anti-Keynesian view of public finances (see Creel *and al*., 2005). However, it does not seem to be confirmed by the data: in the United States, for example, the increase in the real interest rate, in 1980, precedes the public finances worsening whereas the low level of interest rates in the years 2002-2004 goes with a high fiscal deficit. From the theoretical point of view, it raises three questions:

1. What are the conditions for a rise in public deficits to induce a crowding-out effect by means of an interest rate increase? Must economies be at full capacity, or can it occur in periods of long-lasting slump of activity, when a deficit aims at moderating private demand shortage?
2. What is the importance of the interdependence between monetary and fiscal policies?
3. How do financial markets expect future fiscal policy? To what extent do these expectations determine real long rates?

The paper contains three parts. The first displays the theoretical basis of the crowding-out effect. This part shows that there is no crowding-out effect as much as governments do macroeconomic stabilisation fiscal policies. The second part analyzes empirical studies assessing the fiscal policy impact on interest rates. These frequently estimate reduced forms, which do not take into account business cycle effects, the other determinants of interest rates (households' and firms' behaviour), and make debatable hypothesis about how financial markets expect future fiscal deficits. The third part presents central Banks' reaction functions estimates, as well as estimates of long-term interest rate equations for the United States, the

United Kingdom, Germany[1] and Japan for the 1980-2003 period. Fiscal policies seem to have had no direct effect on the short-term rate setting by monetary authorities. They would not have led on the whole to increases in real interest rates for the episode considered.

The theory of fiscal policy – interest rates links

The interest rate theories

The literature studying the fiscal policy effects on interest rates rests on various theoretical explanations of the interest rate. The question is to know if its formation results from a market phenomenon or from an expectation one. In the first case, the fiscal policy impact would come from the disequilibrium produced by the deficit on the saving/investment balance and would be corrected at the current period either by an output increase, or by a rise in prices and/or the interest rate. The second approach consists in considering any interest rate whose maturity is higher than one period as an expectation of lower maturity future rates. The first approach is then incomplete if one introduces bonds of different maturities and the existence of agents arbitraging these bonds. The second one does not clarify how the short rates which will prevail in the future are expected.

The loanable funds theory[2]

The loanable funds theory presumes the existence of a market where the supply and demand for funds meet, *i.e.* households' savings S on one hand, and the government's funding needs, *i.e.* its deficit D, and the firms funding needs, *i.e.* private investment Z on the other hand. It assumes that S is an increasing function of the real interest rate R, and that Z decreases with R. The interest rate achieves equilibrium on the market: $S = D + Z$. A rise in the public deficit boosts the real rate, which increases households' saving and reduces private investment, which permits to achieve equilibrium on the funds market. Full employment must be assumed. In Keynesian regime, a deficit expansion would raise private investment and savings; equilibrium is achieved by an output augmentation, the interest rate being unchanged as the central Bank does not react.

The loanable funds theory seems questionable, since the introduction of several types of financial assets with different maturities requires clarifying how agents decide to hold these

[1] Relating to Germany, the study is restricted to 1980-1998, due to the Euro adoption. Other European countries are not studied because the interest rate formation has there been influenced by the need to stay in the European Monetary System, and then by the credibility of the Euro creation.

[2] See Sargent (1969) and Hoelscher (1986).

assets, which implies the formation of expectations on the yield of each asset, therefore on interest rates.

The expectation theory of the term structure of interest rates[3]

According to that theory, the n-maturity long-term rate I is equal to the weighted sum of expected future short-term rates i_j^a : $I^{(n)} = \frac{1}{n}\sum_{j=0}^{n-1}\left(1+i_j^a\right)$ after linearising.

Segmented markets and agents having a preferred investment or borrowing horizon led Modigliani and Sutch (1966) to suggest the Preferred Habitat theory. According to that theory, agents have a preferred habitat that they are disposed to leave in exchange of a sufficient premium. Long rates are an expectation of future short rates plus a positive or negative premium. Fiscal policy would influence these premiums, via debt issues. The difficulty raised by this theory is twofold, since it is required to clarify agents' habitat and the formation of rates expectations. One should also explain how fiscal policy affects rates expectations to apply the theory to the study of fiscal policy – interest rates links.

The IS/LM model

In that model, the couple output/interest rate is simultaneously determined on the money and goods markets. The fiscal policy effect on the interest rate depends on the monetary policy reaction, and the deficit/interest rate link is not *mechanical* in the short run.

Introducing long-term bonds in the model allows to study the links between debt, deficit, the short rate and the long rate (Turnovsky and Miller, 1984; Blanchard, 1984). Interest rates achieve Households' portfolio equilibrium. The long rate is an expectation of future short-term rates and does not result from the current equilibrium on the bonds market, since bonds supplies and demands are simultaneously determined by the output level. The long rate is thus caused by agents' expectations on the future consecutive states of the economy, which make it possible to make up expectations on the future level of the short rate for each period. In that framework, monetary and fiscal policies are decisive in expectations formation.

The neoclassical growth model

In the Ramsey model of optimal growth, when economy is at equilibrium the real rate is equal to the marginal productivity of capital, plus a risk premium due to Households' risk aversion: $r = \sigma.g + \theta$ (Laubach, 2003; Engen and Hubbard, 2004). g is the growth rate of

[3] See Lutz (1940).

output, capital stock and consumption, σ is the coefficient of relative risk aversion, and θ is the Households' rate of time preference.

The authors assume that an increase in the public debt as a share of output would bring about a corresponding fall of the capital/output ratio, Households' wealth being constant as a share of output (Elmendorf and Mankiw, 1999). The reduction of the capital/output ratio induces a rise in the marginal productivity of capital, which produces an augmentation of the risk free rate.

The hypothesis according to which the real long rate equals the marginal productivity of capital implies that the economy continually be at full-employment and the private capital stock at equilibrium, which is not checked empirically. The model also assumes that the central Bank sets the short-term rate in accordance with potential growth: if it is not the case, agent's arbitrages on financial markets move away the real long rate from the marginal productivity of capital (at least temporarily). Finally, if public debt increases following the will of firms to diminish their debt, there is no augmentation of the real rate, whereas the capital/output ratio lessens subsequent to firms' disinvestment.

The interest rate crowding-out

The crowding-out of private spending by public expenditure can come from an interest rate increase. Several mechanisms are suggested in the literature (Buiter, 1977):

i. *The financial crowding-out*. A public deficit increase which raises output involves a rise in the interest rate, due to a rise in money demand as money supply is unchanged[4].

ii. *The portfolio crowding-out*. An expansion in the stock of public debt needs, in order to be held in agents' portfolio, a rise in long rates relative to short ones (Friedman, 1978).

iii. *The real crowding-out*. When economy is at full-capacity any augmentation of the public expenditure must necessarily lead to a drop of the same amount of private spending. Prices and interest rates must adjust to equalize supply and demand on the goods market.

iv. *The wealth effect*. If Ricardian equivalence does not hold, households take a public debt increase as a private wealth expansion, which stimulates consumption and activity, moves up interest rates, and reduces private investment.

[4] Carlson and Spencer (1975) distinguish the different possible cases in an *IS/LM* model.

v. *The risk premium*. The interest rate on public bonds contains a premium related to the risk of debt monetization, or to the risk that the country would default on its debt.

These arguments are nevertheless open to discussion. The channel (i) depends on the hypothesis of money supply control by the monetary authorities. It disappears if the central Bank adjusts money supply to reach an interest rate target. It implies that strategic interactions between the government and the central Bank are at the heart of any crowding-out effect.

Channel (ii) is very weak empirically (Frankel, 1985). In addition, if firms want to diminish their debts or if households want to hold more financial assets, agents can hold a more significant share of public debt without the interest rate on private bonds being affected.

The risk of debt monetization is very low in OECD countries, whose central Banks, which have been largely independent, aim at controlling inflation since the beginning of the Eighties. In the same way, the OECD countries default risk premium is empirically low (Alesina *and al.*, 1992; Codogno *and al.*, 2003).

Considering the three criticisms raised above, the crowding-out effect takes place in Classical regime (channels (iii) and (iv)). It occurs only if the government does a deficit when that does not prove to be necessary. In the Keynesian regime of demand deficiency, the real rate is below its equilibrium level. A fiscal stabilisation policy then makes it possible to support activity, which increases the interest rate in the short run, without necessarily increasing the equilibrium real long rate.

Monetary policy and fiscal policy

Pro or countercyclical fiscal policy

The financial crowding-out effect is assessed by the fall of private demand consecutive to the rise in the interest rate which follows an increase in public expenditures. Let's assume that the central Bank follows a Taylor rule, which is in conformity with empirical work on central Banks' behaviour (Sterdyniak and Villa, 1977; Taylor, 1993; Clarida *and al.*, 1997). Let's suppose too that inflation is determined by a Phillips curve (Phelps, 1967, 1968; Friedman, 1968):

$$\begin{aligned} &\pi = \pi_{-1} + a.y \\ &y = -\sigma\left(i - \pi\right) + g + d \qquad (1) \\ &i = r + \pi + \lambda\left(\pi - \pi^{obj}\right) + \mu.y \end{aligned}$$

with $\left(a,\sigma,\lambda,\mu\right) > 0$

g is a fiscal policy indicator [5], *d* is an indicator of the private demand, *y* is the output gap, *i* is the short-term nominal rate, π is the growth rate of the GDP price and π^{obj} is the central Bank's inflation target. The output gap positively depends on the public and private demand indicators, and negatively on the real rate.

For the considered period, if deficit increases were generally autonomous, which means that they were not related to the business cycle, they were followed by a rise in the interest rate. If one starts from an equilibrium rate of unemployment, one needs a fall in private spending following an expansion of public expenditures, in order to balance the goods market. It is achieved by an interest rate augmentation subsequent to the inflation speeding up consecutive to the total demand increase. This case assumes that the government boosts the deficit when it is not required. If deficit expansions usually balance private demand shortages, they are followed by an unchanged interest rate (if full compensation) or by a falling interest rate (if partial compensation). In that case, monetary policy and fiscal policy share the weight of the adjustment.

Goals conflicts (Capoen *and al.*, 1994)

Let us now suppose that following a decrease in output, the government pushes up the deficit to support activity. If the central Bank believes that it is likely to increase inflation, monetary authorities raise the interest rate. One can thus observe situations in which the deficit and interest rates both soar. The crowding-out effect comes in that case from a goal conflict between the monetary and fiscal authorities (see Capoen *and al.*, 1994).

Let's then study the reaction of the monetary and fiscal authorities following an inflationary shock and a negative demand one, while varying the weight put on inflation in the respective loss functions of the government and the central Bank.

The monetary and fiscal authorities have different loss functions, while inflation is driven by a Phillips curve:

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[5] For example, in Blanchard (1984), aggregate demand is written: $C+G=(\theta+p).(D+\frac{Y-T}{r+p})+G$. *C* is the private spending, *p* is the probability of death, θ is the subjective actuarial rate, *D* is the public debt, *G* the public spending, *T* is taxes and *r* is the short-term rate. The fiscal policy indicator, *g*, is then: $g=(\theta+p).\left(D-\frac{T}{r+p}\right)+G$, and gauges the positive effect of debt and the negative one of taxes on consumption, and the positive effect of public spending on total demand. Incorporating the government budget constraint induces $g=(\theta+p-r).D+\dot{D}+\left(\frac{\theta-r}{r+p}\right).T$.

$$L_M = y^2 + \alpha_M (\pi - \pi_M)^2 + \beta_M (i - \pi)^2$$
$$L_G = y^2 + \alpha_G (\pi - \pi_G)^2 + \beta_G g^2$$
$$y = -\sigma (i - \pi) + g + d$$
$$\pi = \pi_{-1} + ay$$

The central Bank's reaction function is then:

$$i = \pi + \frac{\sigma}{\beta_M} \left(y + \alpha_M . a (\pi - \pi_M) \right) \qquad (2)$$

Numerical example: the consequences of a positive inflationary shock and those of a negative demand shock each of 1% are now assessed (see table 1). I set $\beta_M = \beta_G = \sigma = a = 1$ and $\pi_G = \pi_M = 0.$ The model's solution gives:

$$y = \frac{-(\alpha_M + \alpha_G)\pi_{-1} + d}{3 + \alpha_M + \alpha_G}, \quad r = \frac{(2\alpha_M - \alpha_G)\pi_{-1} + (1 + \alpha_M)d}{3 + \alpha_M + \alpha_G} \text{ and}$$
$$g = \frac{(\alpha_M - 2\alpha_G)\pi_{-1} - (1 + \alpha_G)d}{3 + \alpha_M + \alpha_G}.$$

If $\alpha_G = \alpha_M = 1$, monetary policy and fiscal policy go in the same direction. Following an inflationary shock the interest rate increases and the public deficit decreases. Following a negative shock of demand, the central Bank diminishes the interest rate and the deficit is raised.

If $\alpha_G = 0$ $\alpha_M = 2$, monetary policy and fiscal policy go in opposite ways. The inflationary shock results in increases in the interest rate and deficit. There is then an opposition between monetary and fiscal policies. Following a demand shock, the interest rate strongly falls, whereas the deficit expands much less than in the first case.

Table 1. Reaction to shocks and goals conflict

	$\alpha_G = \alpha_M = 1$		$\alpha_G = 0,\ \alpha_M = 2$	
Type of shock	Inflationary	Demand	Inflationary	Demand
y	-0.4	-0.2	-0.4	-0.2
r	0.2	-0.4	*0.8*	-0.6
g	-0.2	0.4	*0.4*	0.2
π	0.6	-0.2	0.6	-0.2

Source: author's calculations.

One can then distinguish two polar cases. If the monetary and fiscal authorities have the same loss function, they react in the same way following a shock. One thus notes either a rise in the interest rate and a restrictive fiscal policy, or a lower interest rate and an expansionary fiscal policy. The two policies are not in conflict, which makes it possible for the central Bank not to lower the interest rate too much and for the government not to have a strong deficit. The periods of fiscal deficit are periods of low real interest rates. In some cases, a liquidity trap constraint occurs: the interest rate cannot go down below a minimal value; the fiscal policy supports the adjustment. In that case, the interest rate is very weak while the fiscal deficit is high. The high fiscal deficit cannot be held accountable for the interest rate level. It has been the situation undergone by Japan since 1995 and by the United States from September 2001 to mid-2004.

If the loss functions strongly differ, the monetary authority wants a more restrictive policy than the fiscal one. Following an inflationary shock, the central Bank increases the interest rate while the government supports economic activity by the deficit. The two policies go in opposite ways, and the deficit has a positive impact on the real short-term interest rate. The central Bank uses the interest rate to slow down aggregate demand whereas the fiscal deficit expansion stimulates it. One can thus observe periods of high deficit and strong interest rates (as in Europe in 2002-2003).

In this specification, the monetary authorities do not explicitly take the fiscal authority's behaviour into account. That one could interfere in two contradictory ways: the central Bank could raise its interest rate to discourage the fiscal authority from doing an expansionary policy; in opposite direction, a strong level of debt could force the central Bank to set the interest rate to a low level to prevent the public debt to become unsustainable.

The interdependence between monetary and fiscal policies can thus lead to a simultaneous climb in the interest rate and deficit. This result comes out following an inflationary shock when the monetary and fiscal authorities have different preferences on the weight applied to inflation in their own loss function. On the other hand, there is no crowding-out effect following a negative demand shock, when the economy is in Keynesian regime. The empirically stated link between public deficit and interest rates in the past is therefore not structural; it depends on the past history of the policy-mix; the fact that in the past, monetary and fiscal policies were used in a coordinated or conflicting way does not tell us about the consequences of a current rise in public deficits.

Long-term interest rate, expectations and crowding-out

The crucial point is thus to determine if fiscal policy affects long-term interest rates. These are the real long-term interest rates that matter for private agents' investment choices. Long rates are determined on the financial market. According to the expectations theory, the long-term rate is the average sum of expected short rates. It thus depends on agents' expectations about inflation, the aggregate demand level, and the future monetary and fiscal policies. Let's illustrate that point with a simple model.

The model[6]

Let us consider a closed economy, with three agents: the private non-financial sector (Households and Firms), the Government and the central Bank. Households hold short-term bonds and perpetual obligations, which are exchanged on the financial market. The short-term bonds are of unit price, pay an interest *i*, and whose stock (expressed as a % of the nominal GDP) is worth *b*. Perpetual obligations are in quantity *B*, pay a unit coupon, have a price equal to $p = \frac{1}{I}$, and have an expected holding yield $H = I - \frac{\dot{I}}{I}$, *I* being the nominal long-term rate. $\dot{I} = \frac{dI}{dt}$ is the assumed perfect expectation of the long rate variation between *t* and *t*+1. It is supposed that agents are risk-neutral. The arbitrage equilibrium of the Households' financial assets portfolio implies equality between the expected yield of a perpetual obligation

[6] Similar models are proposed in Blanchard (1984), Turnovky and Miller (1984) and Turnovsky (1989). They analyze the fiscal policy effects on the long rate by introducing an arbitrage equation between the short rate and the long one. They assume that the central Bank controls the money supply. Moreover, Turnovsky and Miller (1984) do not introduce the dynamics of prices. Turnovsky (1989) does not take account of the Government's budget constraint. Blanchard studies a model with gradual adjustment of production and prices, but without budget constraint, the fiscal policy being summarized by a synthetic indicator.

and the short-term nominal rate (equation 3). The long rate is thus the average of expected future short-term rates[7]. The central Bank sets its nominal short-term rate *i* according to the difference between the current inflation and the inflation target $\left(\pi - \pi^{obj}\right)$, and according to the output gap[8] *y* (equation 4). The Households' financial wealth[9] is worth $W = \frac{B}{I} + b$ (5) (as a % of GDP). The inflation dynamics is represented by an expectations' augmented Phillips equation (equation 6); π is the growth rate of the GDP deflator and $a > 0$. Equation (7) represents the long-term expected inflation rate, and $0 \leq \omega < 1$. That specification accounts for empirically stated long memory in long-term inflation expectations formation, and ensures consistency between expected and realized inflation in the long run (Helbling and Wescott, 1995; Brender and Pisani, 1997). The closer ω is to zero, the quicker agents adjust their expectations. If financial markets are forward-looking, non-financial agents are not (as in Blanchard, 1984). Let $R^a = I - \pi^a_{LT}$ (8) be the expected real long rate. Real private demand (equation 9) negatively depends on the expected real long rate and real net taxes T (as a % of GDP), and positively depends on private real financial wealth[10] W_{-1}, with $c, \kappa, \sigma \geq 0$. Equation (10) represents equilibrium on the goods market, *G* being the real public expenditure as a % of GDP. The public debt evolves according to the Government primary deficit $T - G$, and according to real interests $\left(1-\pi\right).B_{-1}$ paid on perpetual obligations[11] (equation 11).

[7] The solution of equation (3), integrating it towards the future and assuming equality between the long rate and the expected short rate at the last period, gives: $I_t = \frac{1}{\int_{t=0}^{+\infty} e^{-\int_t^x i_{t'} \cdot dt'} dx}$

[8] The output gap is written $y = 100.\left(\frac{Y - \bar{Y}}{\bar{Y}} - 1\right)$. Y is the GDP and $\bar{Y}$ is the potential GDP.

[9] Households and Firms' money holding and debt are neglected.

[10] Microeconomic backgrounds of the wealth effect are found in Blanchard (1984), as the infinite horizon hypothesis is neglected. Households' consumption thus positively depends on their net wealth, including the public debt.

[11] The short-term debt is assumed to be constant as a % of GDP and is scaled to zero. The case in which the Government chooses to shorten the maturity of its debt by selling short bonds and buying long ones is not studied.

$$I - \frac{\dot{I}}{I} = i \qquad (3)$$

$$i = r_{-1} + \pi + \lambda.\left(\pi - \pi^{obj}\right) + \gamma.y \qquad (4)$$

$$W = \frac{B}{I} + b \qquad (5)$$

$$\pi = \pi_{-1} + a.y \qquad (6)$$

$$\pi_{LT}^{a} = \omega.\pi_{LT,-1}^{a} + (1-\omega).\pi \qquad (7)$$

$$R^{a} = I - \pi_{LT}^{a} \qquad (8)$$

$$d = -\sigma.R^{a} + \kappa.(1-\pi).W_{-1} - c.T \qquad (9)$$

$$y = G + d \qquad (10)$$

$$\frac{B}{I} = (1-\pi).\left(\frac{B_{-1}}{I} + B_{-1}\right) + G - T \qquad (11)$$

The long run

The long run equilibrium is reached when the debt, the interest rates and the inflation rate are constant: $\frac{\dot{B}}{I} = \frac{\dot{I}}{I} = \dot{\pi} = 0$. The output gap is then nil. So:

$$\overline{\pi}_{LT}^{a} = \overline{\pi} \qquad (12)$$

$$\overline{R} = \overline{I} - \overline{\pi} = \frac{\overline{G} - c.\overline{T} + \kappa.(1-\overline{\pi}).\overline{W}}{\sigma} = \overline{r} \qquad (13)$$

$$\left(\overline{I} - \overline{\pi}\right)\frac{\overline{B}}{\overline{I}} = \overline{T} - \overline{G} \qquad (14)$$

In the long run, inflation expectations are achieved (equation 12). The long run real long-term interest rate $\overline{R}$, is the rate which is compatible with goods market equilibrium (equation 13). It positively depends on the long run levels of debt and public expenditures, and negatively on the long run level of taxes. The long run level of the public debt stems from the Government budget constraint (equation 14). The central Bank reaches its inflation target, which is not necessarily the case (see *Box 1*).

Box 1. Taylor Rule and the equilibrium interest rate (Creel and Sterdyniak, 1999)

The Taylor Rule usually is of the form $i = \rho + \pi + \lambda.\left(\pi - \pi^{obj}\right) + \gamma.y$ (4'), with $\lambda, \gamma > 0$. ρ is a constant supposed to be the equilibrium interest rate, which means the rate that balances the goods market and achieves inflation stability. But that view assumes that ρ is stable and perfectly known. In fact, the rule specification implies that the central Bank does not automatically achieve its inflation target in the long run: a permanent demand increase needs a permanent change in the equilibrium interest rate, which requires a gap between π and π^{obj}. The equilibrium inflation rate depends on monetary policy, fiscal policy and private demand. In order to enforce the long run inflation rate to be equal to its target, the central Bank must have another rule of behaviour. For example, $i = r + \pi$ with $r = r_{-1} + \lambda\left(\pi - \pi^{obj}\right) + \gamma.y$. The central Bank raises the real rate as inflation is above its desired level. Yet in that case, the economy converges in a cyclical (non monotonous) way to its long run equilibrium.

The long run equilibrium depends on the reaction functions of the monetary and fiscal authorities. One cannot assume that public spending and taxes levels are exogenous. A permanent rise in G would then lead to public debt unsustainability and instability of the economy. Let us suppose that the Government sets taxes according to the past level of the public debt: $T = T_0 + f\left(\frac{B}{I}\right)_{-1}$, with $f > 0$ (15). The Government budget constraint compatible with a stable public debt is then: $\frac{\overline{B}}{\overline{I}} = \frac{\overline{G} - T_0}{f - \overline{R}}$. Stability is achieved if $f > \overline{R}$.

G, T and $\frac{B}{I}$ are necessarily interdependent in the long run: when the public debt is stable, $\overline{T} = \overline{G} + \overline{R}.\overline{B}$ is checked.

Crowding-out and deficit financing mode

When the economy is at full-employment, a permanent rise in public expenditures implies an elevation of the long run real long-term rate to adjust total demand and supply. This effect is not the same according to the financing mode.

If the Government finances the rise in public expenditures by raising taxes $\left(\Delta T_0 = \Delta\overline{G}\right)$ *ex ante*, the real long rate augmentation is worth $\frac{\partial\overline{R}}{\partial\overline{G}} = \frac{1-c}{\sigma}$. If the Government finances *ex ante* the new expenditures exclusively by debt, debt increases, which induces a rise in taxes, until

$\overline{T} = \overline{G} + \overline{R}.\frac{\overline{B}}{\overline{I}} = T_0 + f.\frac{\overline{B}}{\overline{I}}$ *ex post*. The real long rate variation is then worth: $\frac{\partial \overline{R}}{\partial \overline{G}} = \frac{1 - c + \kappa / f}{\sigma}$.

In the long run, public expenditures, public debt, taxes and real interest rates are high. The interest rate increases with the stock of public debt, but not with the deficit (which is endogenous): to pay the interests on debt and to respect its budget constraint, the Government must have a positive net primary balance.

Interest rate and countercyclical public deficit

If the public deficit is used by the Government to stabilize economic activity, agents cannot expect the future values of (G,T,B) to be equal to their current value. In times of low economic activity, deficit is high, which would imply a very high debt in the long run and conversely in times of high activity. To test the positive impact of deficit on the real long rate, one must assume that agents expect:

- H1. Either that following a negative demand shock, the fiscal stabilisation policy increases the total present and future demand, which has a short run positive effect on the long-term rate. This effect increases with the public deficit inertia (as agents expect a slow correction of the deficit) and the wealth effect. When the deficit is corrected, the shares of public and private spending in the output and the long run real long-term rate go back to their initial level.
- H2. Either that any variation of the deficit is permanent[12], and will lead to uncontrolled increases in the stock of public debt and inflation.
- H3. Or that deficit is due to a permanent augmentation of public expenditures, which will be followed by an expansion of taxes to stabilize public debt, and which gives place for a crowding-out effect once the economy has gone back to full-employment. Agents

[12] This means that agents expect that there will not be, following a fall of the deficit, a future rise in taxes or lowering of expenditures once the economy has returned to full-employment, therefore that the public debt would increase unceasingly. The Government budget constraint would then be achieved by a passive monetary policy. However, reaction functions estimates confirm that central banks tend to fight against inflation. In addition, from a theoretical point of view, Creel and Sterdyniak (2002) show that in the presence of inflation sluggishness, and a positive wealth effect, the government must correct a high level of debt, economy being unstable otherwise. Finally, in the case of a weak version of the Fiscal Theory of the Price Level, the real long rate would decrease, because of the insufficient reaction of the central Bank *vis-à-vis* inflation. Debt would then have a negative impact on the real long rate, unless agents ask a risk premium related to the stock of public debt and to the risk of its monetization.

expect a future in which real debt and rates will be higher as full-employment is achieved. The real interest rate boosts, due to expectations, especially as the wealth effect is large.

The search for a systematic correlation between public deficit and real rates presumes that any variation of the deficit is the outcome of a fiscal policy which would bring about, in the long run, a too high level of public expenditures and debt.

If the deficit comes from a fall in taxes, the effect on real interest rates depends on the way by which the market expects the Government budget constraint will be achieved: if it expects that the Government will have to raise taxes, the deficit has a positive impact on long run real long rates, because of the expected accumulation of debt. If the market expects a collapse of the future public expenditure, the long run real long-term interest rate must drop so that the increase in private demand balances out the cut in the public demand (Cohen and Garnier, 1991). A rise in the deficit can thus involve at the same time a reduction of the long run real rate and an augmentation of the stock of public debt. The computation of the crowding-out effect thus requires jointly considering the deficit effect with that of the structural public expenditure (as a % of potential GDP).

In all the cases, one has to assume that Households have the capacity to distinguish between transitory variations of public expenditure and permanent ones, when they build their expectations on future short-term rates (Feldstein, 1982).

Numerical example: How does the Government react when a temporary fall in private demand occurs[13]? Let us suppose that the Government adjusts its expenditures according to the output gap $G = -y$ (16), and that there is no wealth effect. In response to the shock, the central Bank lowers the short rate. The Government boosts its expenditures to support activity, and sells perpetuities. Private agents know that the private demand shock will vanish, and that the debt accumulation implies a future rise in taxes. They know that fiscal policy is perfectly reversible, and expect a gradual increase of the short rate as inflation turns over towards its target. The long rate falls less than the short rate, and the difference between the long rate and the short one expands. One temporarily views a rise in public expenditures and a fall in the real long rate: there is no crowding-out effect. One can depart from this scenario in three ways.

[13] The following shock $x_t = -1, t = 1$, and $x_t = 0, t > 1$ is assumed.

i. Public expenditures are sluggish and return slowly to their initial level. Let us suppose that: $G = 0.7G_{-1} - y$. In that case, fiscal policy has a specific effect on the nominal and real long rates, which drop less than in the standard case, because of the public expenditures sluggishness (table 2). Agents expect that once the shock has vanished, public expenditures will momentarily be too high, involving a faster increase in the short rate. In the long run, there is no crowding-out yet.

ii. The public debt has an effect on the level of private demand: $\kappa = 0.1$. The nominal and real long rates fall less than in the standard case (table 2), since debt has a positive effect on demand, consequently on future inflation and expected short rates. This effect is delayed because of the public debt accumulation dynamics.

iii. The central Bank strongly reacts to inflation: $\lambda = 0.7$. The short rate drops more than in the standard case, which transmits to the long rate. In the short run, the long-term interest rate fall depends on the central Bank's reaction coefficients to inflation and output.

Table 2. Effects of a 1% temporary slow down of private demand

	Standard case		Sluggishness of *G*		Wealth effect		Strong reaction to inflation	
Period:	1	2	1	2	1	2	1	2
y	-0.41	0.03	-0.42	0.15	-0.41	0.05	-0.40	0.04
G	0.41	-0.03	0.42	0.15	0.41	-0.05	0.40	-0.04
i	-0.51	-0.27	-0.52	-0.13	-0.51	-0.25	-0.54	-0.29
I	-0.42	-0.26	-0.39	-0.13	-0.42	-0.24	-0.45	-0.28
π_{LT}^{a}	-0.06	-0.10	-0.06	-0.08	-0.06	-0.10	-0.06	-0.10
R	-0.36	-0.16	-0.32	-0.05	-0.35	-0.14	-0.39	-0.19

The model consisting of equations (3), (4'), (5) to (11), (15) and (16) is simulated assuming $\rho = R = G = T = B = b = d = y = 0$, $\pi = \pi^{obj} = i = I = 2\%$, and $a = \lambda = \gamma = \sigma = c = 0.5$, $\omega = 0.7$, $f = 0.1$. Results are given in deviation with the central account.
Source: Author's calculations

The macroeconomic regulation fiscal policies have a short run impact on real rates. This impact must be distinguished from the long run impact resulting for example from a too high level of public debt or spending. Only the latter two entail a crowding-out effect. A given deficit has not the same effect on interest rates whether agents expect it is transitory or permanent.

Desired wealth and crowding-out (Creel and Sterdyniak, 1995)

When Ricardian equivalence is not met, the public debt has an impact on interest rates when economy is in Classical mode. The public debt held by Households belongs to their wealth. An exogenous rise in the debt has a positive effect on interest rates, necessary to lead Households to hold the additional debt. Conversely, if the public debt increase follows some Households' decision to enlarge their assets held, or a will of Firms to diminish their debt, the effect on interest rates can be nil (Creel and Sterdyniak, 1995).

Let us suppose that private agents want to hold a net level of non-risky financial assets being worth, expressed as a percentage of GDP: (17) $h = \alpha + \beta R^a$. Equation (9) is now[14] $d = (1-\tau)Y + (1-\pi)B_{-1} - \pi.\frac{B_{-1}}{I} + \mu\left(\frac{B}{I} - h\right)_{-1}$ (18). $(1-\pi)B_{-1}$ stands for the real interests on debt received by Households, and $-\pi.\frac{B_{-1}}{I}$ represents the depreciation of the Households' financial wealth due to inflation. Income is taxed at rate τ.

The Government account equilibrium imposes that in stable equilibrium $\tau.Y = G + R.h$. It is assumed that the Government adjusts the public expenditure to satisfy its budget constraint on the one hand, and to achieve a public debt level target Φ on the other hand. The reaction function of the fiscal authority is now: $G = \tau.Y - (1-\pi).B_{-1} + \pi.\frac{B_{-1}}{I} + \nu.\left(\Phi - \frac{B}{I}\right)$ (19); $\nu > 0$ is the adjustment speed of the deficit.

Following a rise in the households' desired wealth[15], the Government faces two strategies. The first consists in adjusting the public spending in order to depress the real long rate, so that Households wish *in fine* to hold the stock of public debt target Φ. In that case, the equilibrium interest rate is worth: $R = (\Phi - \alpha)/\beta$. Public expenditures drop in the short run, which brings about a fall of real interest rates and of the stock of non-risky assets desired by Households. In the same time, the short run income reduction induces a more significant retrenchment of taxes, which involves a rise in the public debt. In the long run, the real long rate is weaker and public debt returns to its initial level Φ. The drop in interest payments

[14] See Creel (2002) for a justification of the consumption function used.

[15] This increase involves a rise in α.

makes it possible for the Government to expand its expenditures. One can thus observe in the short run a rise in the stock of public debt parallel to a fall of real interest rates and a drop of real rates parallel to an unchanged level of public debt in the long run. The tricky point is that the Government has no guarantee on the real interest rate level related to its public debt target.

The other possible strategy is that the Government accepts a deficit until the public debt reaches the new level of non-risky assets desired by Households, keeping up the initial interest rate, which is considered optimal. In the short run, the Government raises its expenditures and the debt expands. In the long run, debt is stabilized at the level wished by Households. The Government must cut its current spending to face the increase in interest payments on its debt. The real and nominal interest rates go back to their respective initial levels.

A sustained rise in the public debt level does not systematically require the real interest rates to get higher. Taking the private behaviours of financial assets holding and debt into account is essential to explain the long run level of interest rates.

Some tenuous empirical links

A long-term interest rate increase can be induced by an expectation of a too high (public or private) demand in the future, by the expectation that a too high debt level will involve a too high private demand level or that the debt will encourage the government to choose a higher level of inflation, or else by a premium related to the government’s default risk.

The fiscal policy variables

The empirical assessment of the fiscal policy effects on interest rates needs to define the relevant fiscal variables to test that effect. Two variables are generally used: the public deficit and the public debt.

The public deficit

The countercyclical part of fiscal policy must be separated from the autonomous deficit, in order to quantify the impact of the deficit. According to Creel and Sterdyniak (1995), the public deficit splits into four parts: the autonomous deficit *AD*, the automatic cyclical deficit *ACD*, the discretionary cyclical deficit *DCD* and the interest payments on debt *IP*. The real long rate and *ACD* and *DCD* fluctuate in opposite ways: for example, following a negative demand shock, *ACD* and *DCD* boost, while the real long rate falls[16]. *IP* positively depends on the real long rate, an increase in the last automatically involving a rise in interest payments. The crowding-out effect is brought about by *AD*, the current or expected autonomous deficit, which corresponds to a too high demand in the long run.

The data from the European Commission or from the OECD Economic Outlook Database allow computing *AD+DCD*, the primary structural (cyclically-adjusted) deficit (*PSD*). The econometricians, who do not separate *AD* and *DCD*, but assess the *PSD* impact on the real long rate, test the agents' expectation of a higher inflation rate chosen by the government in the future (H2 assumption), or of a too high public demand in the long run (H3 assumption), but also the cyclical effect of *DCD* on aggregate demand, therefore on interest rates, although in the long run *DCD* has no impact on the real long rate (H1 assumption).

Looking at the *SPS* (Structural Primary Surplus) and output gap (see chart 1), one can note that the *SPS* plummets in times of lack of demand, and climbs in periods of strong demand, when tensions on production capacities may bring on inflation and a rise in real rates. That is checked particularly after 1992 for the United States, and 1988 for the United Kingdom and Japan. In Germany, fiscal policy seems more pro-cyclical, especially because of the reunification.

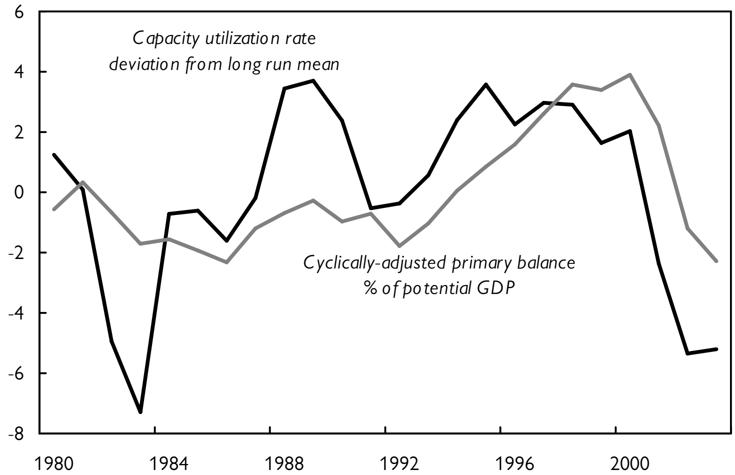
Countercyclical fiscal policies done during 1980-2003 must thus lead to some carefulness in the results analysis: a positive effect of the *SPS* on the real long rate can stem from the stabilisation discretionary fiscal policy, which is countercyclical, rather than from a crowding-out effect, arising from a pro-cyclical fiscal policy. It is thus necessary to take into account, in the estimate, the business cycle effect on the interest rate, by incorporating an indicator of the business cycle. In addition, empirical inertia of the *PSD*[17] leads to a specific impact of the deficit on the interest rate (agents expecting a slow correction of the deficit). That effect is difficult to assess but is not a crowding-out effect since once the deficit has been corrected, the distribution between public expenditure and private expenditure on the one hand, and the long run real rate on the other hand return to their initial levels. Eventually, the deficit effect resulting from reduced taxes is not the same one on the long rate according to whether it is expected to be corrected by a future rise in taxes or a future fall of expenditures. However, the cyclically-adjusted levels of primary public expenditure remained relatively stable as a share

[16] But it falls less than in the case when the government does no stabilisation policy. In case of supply shock, it also depends on the monetary and fiscal authorities' particular preferences.

[17] See Creel *and al*. (2002) for fiscal rules estimates illustrating the primary structural surplus inertia.

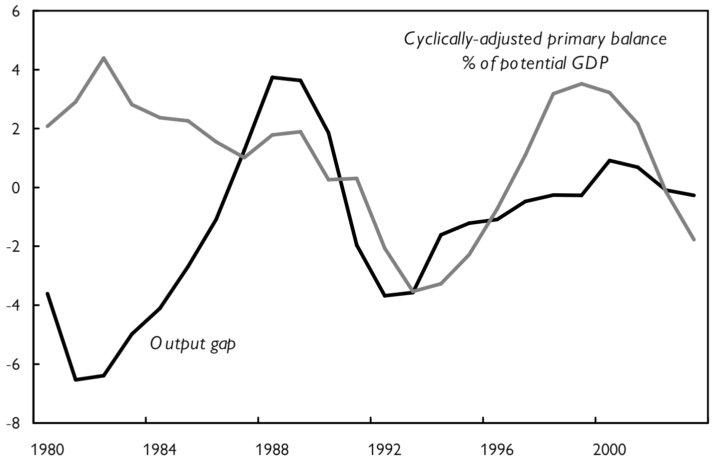
of the potential GDP on the 1980-2003 period (see chart 2), except in Japan, where expenditures have been in constant expansion since the beginning of the Nineties and the start of deflation. A specific effect of the primary public spending on interest rates is then not expected to be found.

1a. Capacity utilization rate and cyclically-adjusted primary balance; United States



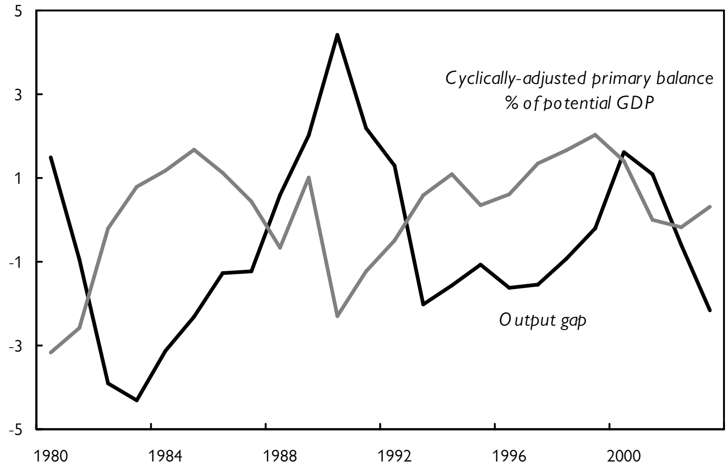
Sources: Federal Reserve, OECD Economic Outlook 76, author's calculations.

1b. Output gap and cyclically-adjusted primary balance; United Kingdom



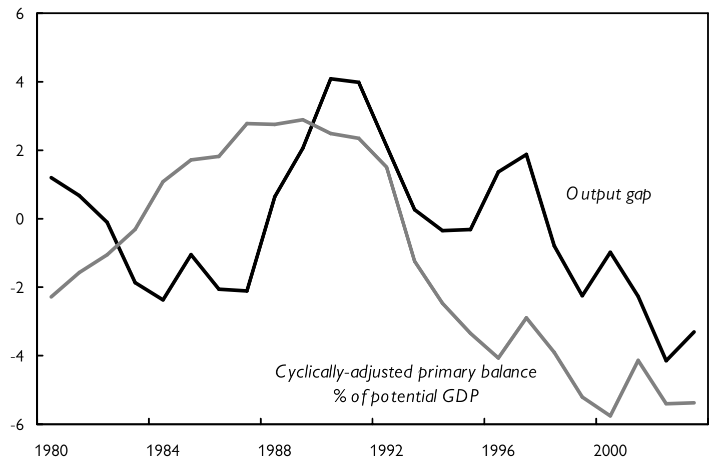
Sources: OECD Economic Outlook 76.

1c. Output gap and cyclically-adjusted primary balance; Germany



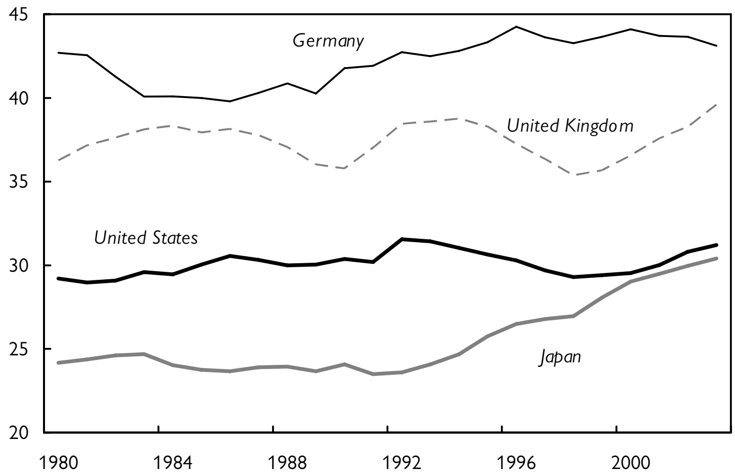
Sources: OECD Economic Outlook 75-76.

1d. Output gap and cyclically-adjusted primary balance; Japan



Sources: OECD Economic Outlook 76.

2. Cyclically-adjusted primary public spending, % of potential GDP



Sources: OECD Economic Outlook 76, author's calculations.

The public debt

Several concepts of public debt[18] are identifiable. The gross public debt includes all the liabilities (bonds and loans) of a country. If one tries to gauge the wealth effect related to the holding of public debt, the concept of debt held by the private non-financial sector appears more appropriate[19]. The net debt is the most relevant concept to measure its impact on the private behaviours and on interest rates. However, it does not include commitments (or future contributions) related to the retirement systems (Elmendorf and Mankiw, 1999). In order to measure the wealth effect, it would also be necessary to add to the net public debt the net foreign debt (what is hardly ever done).

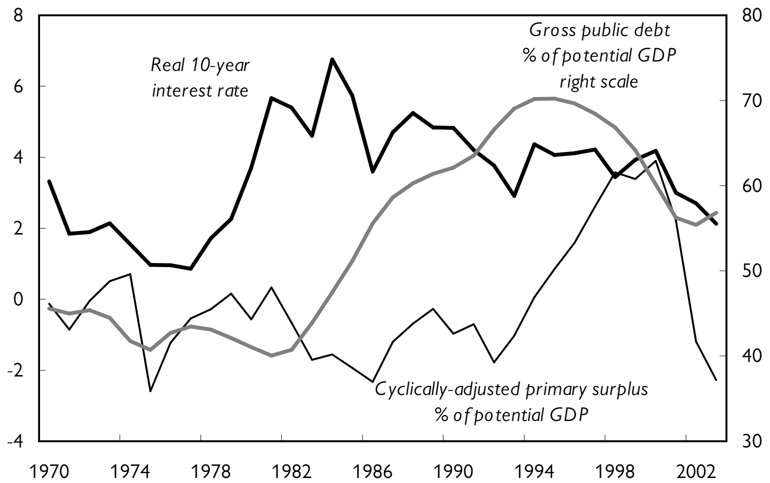
Looking at the combined evolution of the real long rate and fiscal variables, one can check that there is no mechanical link between them. The US real long-term interest rate increases in 1980, two years before the public debt expansion (see chart 3). In Germany and Japan, public debts have continuously risen since 1970, as real rates have stayed comparatively stable. Between 1980 and 2003, the public debt has fallen by about six points as the real long rate has grown by about three points in the United Kingdom. The tradition consisting in explaining the level or the variations of the real long rates by fiscal policy variables[20] does not tell us the whole story.

[18] See Elmendorf and Mankiw (1999) for a discussion.

[19] There is a series of debt held by the public for the United States, but this concept relates to the federal debt, and includes for example the federal debt held by the States and local Governments or that held by the FRBS (Federal Reserve Banking System). The debt held by the non-financial sector can be rebuilt starting from the *Flow of Funds* for the United States, but the concepts of gross and net public debt rebuilt starting from the financial accounts of the countries studied, or calculated by OECD are preferred (cf annexes I): these are the series which are generally used to measure the effect of the public debt on interest rates.

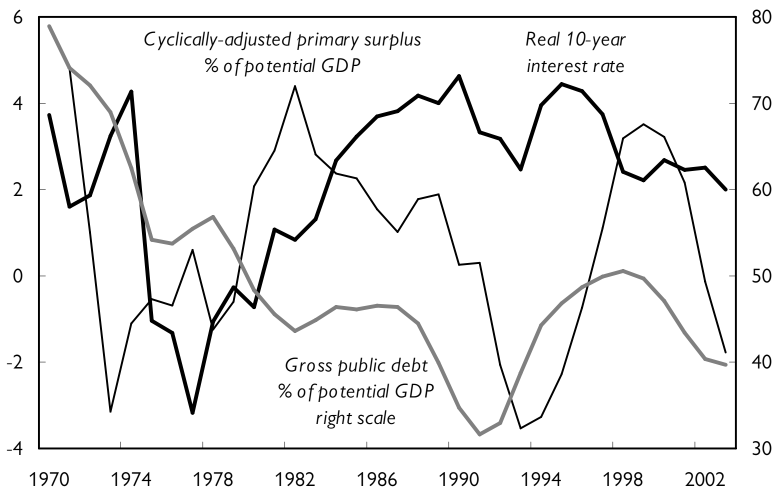
[20] As in Ford and Laxton (1999) for example.

3a. Real long-term interest rates and public finances; United States



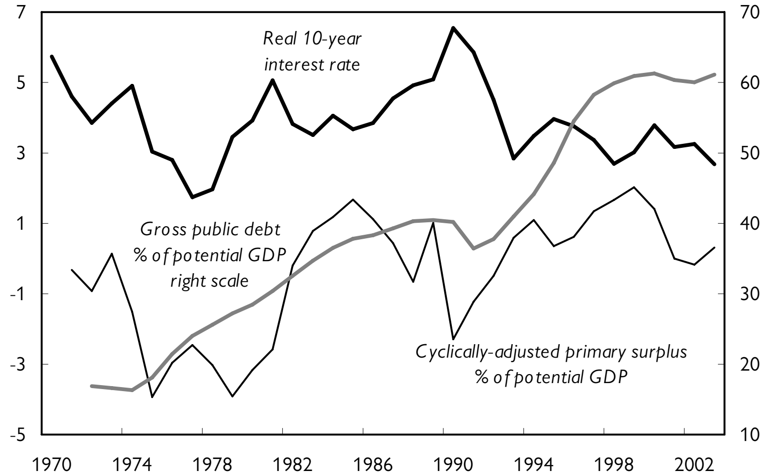
Sources: Federal Reserve, OECD Economic Outlook 76, author's calculations.

3b. Real long-term interest rates and public finances; United Kingdom



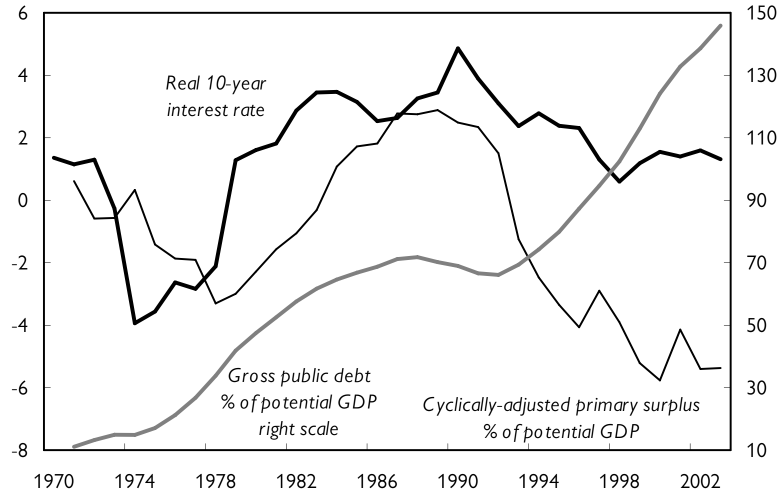
Sources: Bank of England, Office for National Statistics, OECD Economic Outlook 76, author's calculations.

3c. Real long-term interest rates and public finances; Germany



Sources: Bundesbank, Datastream, OECD Economic Outlook 76, author's calculations.

3d. Real long-term interest rates and public finances; Japan



Sources: Datastream, Ministry of Public Management, Home Affairs, Posts and Telecom, OECD Economic Outlook 76, author's calculations.

Empirical studies

The empirical studies of the public debt and deficits effects on interest rates are numerous[21]; they display a great diversity of results[22].

Barth *and al.* (1991) and Correia-Nunes and Stemitsiotis (1995) classify empirical works relating to the links between interest rates and public deficits according to whether one measures that impact on short-term or long-term rates. They notice that studies on short-term rates generally come to the conclusion that there is no effect of deficits or debt on short-term rates. Mehra (1996) finds no evidence of any impact of fiscal variables on the short-term interest rate. Clarida *and al.* (1997), for example, do not test if the public deficit has an impact on it. Especially, there is no evidence that a high level of public debt would force the central Bank to set the interest rate low so as to avoid the public debt to become unsustainable.

Two types of long-term interest rate equations are estimated. The first consists in including the short-term rate as an explanatory variable of the long rate, which supposes that the monetary policy has an effect on long rates by means of arbitrage behaviours on the financial market (subsections 1, 2 and 3). The second type consists in assuming that the real long rate is determined by agents'expectations regarding the long run of the economy (goods market equilibrium or the marginal productivity of capital), without direct effect of the monetary policy (subsections 4 and 5).

The loanable funds framework

This theory is often called upon to measure the crowding-out effects (Hoelscher, 1986; Barro and Sala I Martin, 1990; Mehra, 1992, Correia-Nunes and Stemitsiotis, 1995; Cebula, 2000; Caporale and Williams, 2002). The estimated equation usually has the following reduced form: $I = \alpha X + \varphi_1 FS + \varphi_2 B$, I being a long-term interest rate, and X a matrix representing monetary policy (usually the short rate), inflation expectations, a probable effect of foreign rates, and conditions on the goods market, of which the effects are computed by

[21] See Brook (2003) and Laubach (2004) for a recent survey of this literature, and Barth *and al.* (1991) for an exhaustive survey on studies published up to the end of the eighties.

[22] Among the studies which obtain a positive linkage between long-term interest rates and the fiscal deficit, one can mention Hoelscher (1986), Correia-Nunes and Stemitsiotis (1995), Miller and Russek (1996), Cebula (2000), and Ardagna *and al.* (2004). Others do not stress this relationship: Evans (1985, 1987a, 1987b), Mehra (1992), Breedon *and al.* (1999), or Caporale and Williams (2002). The effect of the public deficit on the US long-term rate is sometimes negative (Evans, 1985; Caporale and Williams, 2002), sometimes nil (Mehra, 1992), sometimes positive (Correia-Nunes and Stemitsiotis, 1995; Ford and Laxton, 1999). Moreover, it is usually hard to find a positive and significant effect of the debt on the real long rate. For example, Ardagna *and al.* (2004) always find a negative or insignificant effect of the debt on the long rate.

vector α . φ_1 gauges the specific impact of the fiscal surplus FS on the demand for loanable funds, therefore on the real long rate, and φ_2 measures the effect of the stock of public debt[23]. For example, Correia-Nunes and Stemitsiotis (1995) and Caporale and Williams (2002) estimate the following equation: $I = \alpha_0 + \alpha_1.r + \alpha_2.\pi^a + \alpha_3.\dot{Y} + \varphi_1 FS + \varphi_2 B$. r is the real short-term rate, π^a is the expected inflation, and $\dot{Y}$ is the growth rate of GDP. That equation is miss-specified: especially, one doesn't know if fiscal variables stand for expectations on future goods market disequilibrium, thus on inflation and short rates, or if they stand for the current arbitrage of agents between short and long bonds[24]. It also assumes that fiscal variables are the only one to have an effect on that disequilibrium or that arbitrage. To be consistent with the loanable funds theory, it would be necessary to precisely analyze the demand for funds from Firms, their debt, and funds offered by Households[25].

Correia-Nunes and Stemitsiotis find a negative effect of the fiscal surplus on the long rate for 10 OECD countries for the 1970-1993 period. But the fiscal surplus data are not cyclically-adjusted and include interest payments on debt, which is also the case for other studies (Hoelscher, 1986; Mehra, 1992; Caporale and Williams, 2002). Estimates are not robust to period changes, illustrating the difficulty to compute reduced form equation estimates on long periods.

To illustrate these last criticisms, the equations of Correia-Nunes and Stemitsiotis (1995) have been estimated for the 1978-2003[26] period. There are 7 cases out of ten in which the current fiscal surplus has a significant impact on the long nominal rate (table 3). Appendix II displays results computed from data coming from the same sources than those of Correia-Nunes and Stemitsiotis on a similar period. The results corroborate those showed in table 3 and also show the strong dependence of the results on the methodology used. Finally, when the cyclically adjusted primary balance replaces the current fiscal surplus, and if the output

[23] The justification of the inclusion of the stock of debt lies either on a risk premium, or on a wealth effect. Caporale and Williams (2002) raise the possibility of a quality effect: when the public debt of a country is low, new bond issues are highly valued, and replace riskier bonds in agents' portfolios. The stock of debt would then have a negative effect on the interest rate.

[24] The authors do not distinguish between the short-term and long-term financed public debt.

[25] Barro and Sala I Martin (1990) do it, but in an incomplete way: they simultaneously estimate equations of investment with equations of interest rate, without finding any significant crowding-out effect.

[26] A homogenous time period for all countries has been preferred, which restrains the estimation period. Data used to compute results showed in tables 3 and 4 are different from those used by Correia-Nunes and Stemitsiotis: they come from the OECD Economic Outlook n°74, 75 and 76, apart for the United Kingdom price index (See Appendix I).

gap is introduced into the estimate[27], the effect is significant in only 3 cases out of 10 (table 4).

Correeia-Nunes and Stemitsiotis' work can't then be seen as a strong empirical ground to assert that there is a *mechanical* effect of the fiscal balance on the long-term interest rate. The results show that the link is neither statistically strong, nor robust, whatever the estimation period (see appendix II for results for 1971-1993).

Table 3. New estimates of Correia Nunes and Stemitsiotis (1995) equations; 1978-2003.

	C	r	π^a	FS	R^2	DW
United States	1.86 (4.93)	0.74 (6.64)	0.59 (7.07)	-0.44 (-4.68)	0.94	1.42
Japan	1.24 (1.83)	0.77 (4.79)	0.97 (13.99)	-0.02 (-0.19)	0.91	1.68
Germany	2.56 (5.77)	0.49 (7.94)	1.05 (6.92)	0.07 (0.69)	0.82	0.93
France	1.04 (2.15)	0.67 (11.34)	1.07 (27.67)	-0.33 (-2.62)	0.95	1.05
United Kingdom	1.42 (3.21)	0.59 (8.92)	0.84 (17.46)	-0.33 (-4.47)	0.94	1.52
Canada	3.79 (11.63)	0.34 (3.71)	0.64 (7.22)	-0.23 (-4.48)	0.91	1.13
Belgium	3.55 (9.18)	0.38 (3.05)	0.41 (3.48)	-0.29 (-3.29)	0.94	1.86
Denmark	1.78 (5.31)	0.48 (7.92)	1.42 (29.12)	-0.20 (-2.16)	0.97	1.49
Ireland	3.14 (2.90)	0.45 (3.63)	0.67 (3.20)	-0.28 (-1.84)	0.95	1.61
Netherlands	2.49 (6.34)	0.55 (6.70)	0.66 (7.52)	-0.31 (-3.05)	0.86	1.06

NB: t-stats are given in parenthesis. GMM estimates; r : short-term real interest rate; π^a : expected inflation; *FS*: current fiscal balance, as a % of GDP.
Sources: OECD Economic Outlook, UK National Statistics, author's calculations.

[27] The world output gap is obtained by aggregating output gaps of each of the countries, weighted by the respective weight of each country in the whole GDP of the considered countries (real GDP at purchasing power parity, computed by OECD). The same weights were utilized to build the other instruments.

Table 4. Effect of the cyclically-adjusted primary balance on the long-term rate.

United States	-0.42 (-3.43)	Canada (1981-2003)	-0.18 (-2.71)
Japan	0.01 (0.05)	Belgium	0.29 (1.43)
Germany	0.37 (3.20)	Denmark	-0.11 (-0.62)
France	0.09 (0.52)	Ireland (1979-2003)	-0.20 (-0.77)
United Kingdom	-0.21 (-2.89)	Netherlands	0.17 (0.45)

NB: t-stats are given in parenthesis. GMM estimates.
Estimated equation: $I = \alpha_0 + \alpha_1.r + \alpha_2.\pi^a + \alpha_3.y + \varphi_1 SPS$; y : output gap; *SPS*: cyclically adjusted primary surplus, as a % of potential GDP.
Sources: OECD Economic Outlook, UK National Statistics, author's calculations.

The interest rate term structure expectations theory

Some studies are based on the expectations theory of the term structure of interest rates to investigate the impact of fiscal variables on interest rates: an expected rise in the deficit or public debt leads agents to expect an elevation of short rates in the future; long rates instantaneously augment. One then only has to estimate the effects of debt and deficit forecasts on the difference between the long rate and the short rate. An expectation of a public debt increase must have a positive effect on the difference between the long rate and the short rate. The current deficit can also be used, because it gives information about the future evolution of the public debt, and all the more as it undergoes a strong inertia.

Canzoneri *and al.* (2002) and the European Commission (2004) estimate the equation: $I - i = \alpha + \beta.FS^e$. FS^e is the expected fiscal surplus (either the current or the forecasted surplus) and i is the nominal short-term rate. This specification is not correct: if the public balance declines during slow GDP growth periods, the short rate is weak, increasing the gap between the long rate and the short rate. The difference between the long and short rates is then also explained, in the short run, negatively by the output gap: $I - i = \alpha + \beta.FS^e - \gamma.y$ [28].

[28] Laubach (2004) investigates the current deficit effect on the long/short rates spread. He reports a positive significant effect for the United States, Japan and the United Kingdom, but an insignificant one for Germany, France, Italy and Canada. The author does not include the output gap. Cohen and Garnier (1991) use one year-ahead OMB forecasts of the US surplus, without taking into account the business cycle effect. Yet the surplus inertia involves that these forecasts still depend on the business cycle.

The European Commission (2004) includes the output gap in the estimate, but output gaps estimated by the European Commission are underestimated overall (Passet *and al.*, 1997). The structural balance used thus takes insufficiently into account the business cycle effects on the current public balance, and there is a risk that the negative effect of the structural balance on the difference between the long rate and the short rate be a short run one.

Some authors argue that the use of long-term projections of the public surplus (5 to 10 years for the Office for Management and Budget's (OMB thereafter) forecasts for the United States) allows to be get rid of the business cycle effects on fiscal policy. However, the discretionary stabilisation fiscal policy should not be systematically seen equivalent to an autonomous deficit. Thus, according to estimates of fiscal reaction functions, the *SPS* increases when the output gap improves. However *FS* forecasts at several years do not take this discretionary policy reversibility into account, since they are based on fiscal decisions adopted up to their product. These forecasts do not correctly reproduce the autonomous character of the expected public deficit since they integrate *DCD* into *AD*.

To illustrate these points, the Congressional Budget Office's (CBO thereafter) 5-year public balance projections carried out at the beginning of each year over 1983-2003[29] have been rebuilt. The impact of these projections on the difference between the US long and short rates has then been assessed (see table 5). When the output gap is included in the estimate, the public balance effect is not significant any more, whether the total or the primary forecasted surplus is used.

[29] Following Canzoneri *and al.* (2002), the average of the forecasted fiscal surplus for the five next years following the year of the forecast is computed. The average forecasted surplus is divided by GDP of the current year. I am grateful to M. Canzoneri for providing the fiscal surplus data used in their 2002 paper.

Table 5. Interest rate spreads and 5 year-ahead fiscal balance forecasts. 1983-2003.

	Total surplus		Primary surplus	
α	1.55 (6.35)	1.62 (10.45)	2.20 (12.41)	1.86 (9.90)
β	-0.20 (-3.46)	-0.09 (-1.60)	-0.25 (-3.50)	-0.07 (-0.96)
γ		-0.32 (-2.45)		-0.34 (-2.77)
$\bar{R}^2$	0.26	0.49	0.25	0.45
DW	1.13	1.73	1.25	1.77

NB: Newey-West corrected t-stats are given in parenthesis. Least squares estimates.
Estimated equation: $I - i = \alpha + \beta.FS^e + \gamma.y$. *I*: 10-year nominal rate on US Treasury Securities; *i*: 3-month nominal rate on Treasury bonds (see Appendix I).
Sources: CBO, BEA, OECD Economic Outlook, Federal Reserve, Canzoneri *and al.* (2002), author's calculations.

IS/LM framework

Evans (1985, 1987a, 1987b) builds the following reduced form of the interest rate: $I = c_0 + c_1.G + c_2.FD + c_3.\frac{M}{P}$, *G* being the public spending, *FD* the public deficit and $\frac{M}{P}$ the real money stock. Evans explores if the public expenditure and deficit have an effect on the interest rate level (Evans, 1985; 1987a), or on its variations (Evans 1987b). Evans uses the current deficit (Evans, 1985), the expected one (Evans, 1987a) or the unexpected one (Evans, 1987b). Evans does not find any effect of the public deficit on the interest rate, and reports a positive effect of the public expenditure. One can't state if the measured effect is a short run or a long run one: the author does not adjust the fiscal variables from the business cycle effects. The estimates also rest on the assumption that expected inflation depends on the same explanatory variables as the interest rate, and can thus be eliminated from the reduced form, which appears to be a strong assumption. From the econometrical point of view, Evans' work has been criticized for the use of a VAR methodology that seems unsuitable to build agents' expectations on future fiscal policy.

The neoclassical growth framework

Laubach (2003), Engen and Hubbard (2004) and Gale and Orszag (2004) estimate an equation in which the real long rate positively depends on the current or expected stock of public debt, negatively on the agents' risk aversion, approximated by the risk premium on shares[30], and positively on the potential growth rate of GDP. The debt effect on the real long rate is then estimated between 0.03 and 0.05 point of interest rate for one point of expected public debt. A 1-point increase in the forecasted deficit raises the interest rate by 0.25 point.

The forecasted deficit is strongly correlated with the current one, which questions its ability to add new information about the long run expectations of deficit. The reported tests show a significant effect on the 5-year-ahead 10-year yield, but no significant effect on the current 10-year Treasury yield. Finally, the assessed effect could be an announcement effect: reported tests are done on yields quoted the last day of the month the forecast is made available. On this point, Quigley and Porter-Hudak (1994) show that deficit-forecasts announcements have only temporary effects on interest rates.

The distinction between short and long run effects

Artus *and al.* (1990), Howe and Pigott (1991) and Orr *and al.* (1995) distinguish short run and long run effects in the long-term rate fluctuations[31]. The estimated equations are based on an error correction model[32]. Artus *and al.* (1990) sustain that long rates are mainly set by short-term factors, stemming from a portfolio model: the short-term rate is the main explanatory variable of long rates in the USA, Germany and France between 1960 and 1987, along with the past empirical variance of the long rate and with the covariance between the long rate and inflation. The authors want to explain long run determinants of the US long rate. They find no effect of the public bonds supply, and find even a negative effect of public expenditures on the long rate.

Howe and Pigott (1991) estimate the Wiksellian natural interest rate: the equilibrium long-term interest rate would be explained by the return on capital, the total non-financial debt/GDP ratio (and not only the public debt/GDP ratio), and by the public bonds contribution to the total risk of a domestic portfolio (including bonds and shares). The market rate would deviate from it due to fiscal and monetary policy actions. The estimate, over 1975-1990,

[30] The premium on equities is computed as the dividend component of national income, expressed as percent of the market value of corporate equity held by households, minus the 10-year Treasury yield, plus the trend growth rate. It is an *ex post* assessment of the return on equities, that does not account for the expected capital gain on households' held equities.

[31] Orr *and al.* (1995) explain long run real long-term rates by persistent public deficits over 1981-1994, without reporting any significant effect of structural deficits and public debt levels in the long run estimates: they use the current deficit, which is not suitable as it contains business cycle effects. Moreover, they find no significant effect of the current deficit over 1975-1994.

[32] Error correction model estimates assume that agents on financial markets have backward-looking expectations. In addition, parameter estimates assessing the correction speed are small, which would mean that agents slowly correct the errors they note. It can hardly be reconciled with empirical observations establishing fast adjustments on financial markets.

results in concluding that the rise in the non-financial total debt contributed for 5 points to the augmentation of the Japanese equilibrium real long rate, 6.5 points for the United Kingdom's one, and 0.8 points for that of the United States. It is however difficult to incriminate the public debt in the first two countries: their net public debt declined between 1980 and 1990. In addition, the lack of decomposition of total debt between private debt and public debt prevents from measuring the possible respective contributions of each one to the rise in the equilibrium real long rate.

Empirical studies hardly ever distinguish the short and long run effects. They often have the default not to distinguish between the current and cyclically-adjusted fiscal surpluses. One learns nothing saying that the long-term interest rate is higher than the short-term rate when the economic situation is bad (and thus the current fiscal surplus is negative). Studies seldom consider private agents' debt and households' desired wealth. Last of all, one can fear that they do nothing but highlighting the opposite correlation: the upsurge of real rates after 1980 compelled governments to engage in fiscal policies of macroeconomic stabilisation. The public debt has burst out because of a snowball effect (Creel and Sterdyniak, 1995).

Empirical estimates of the public finances effect

This part analyzes the empirical links between fiscal variables and interest rates. The first section displays the results of monetary reaction functions estimates. The second section presents results of real long rates estimates. The third section is a try to bring together monetary policy, the evolution of the current nominal long rate, and the long run real rate.

Monetary policy and fiscal policy

Central Banks' reaction functions are estimated, including the cyclically-adjusted primary public expenditures, the cyclically-adjusted primary balance (% of potential GDP), and the public debt[33] (% of GDP). The estimated equation is then: $i = \rho.i_{-1} + (1-\rho).\left(\alpha + \lambda.\pi + \mu.y + \nu_1.\dot{Y} + \nu_2.i^* + \gamma_1.SPS + \gamma_2.G + \gamma_3.B\right)$.

[33] For Japan, Germany and the United Kingdom, I use the gross public debt, and the net one for the United States. In the last case, the standard error estimate with the net debt is smaller than with the gross one. Conclusions about the fiscal variables impact on the short-term rate are the same whatever debt series is used.

Table 6. Central Banks' reaction functions estimates

Périod	United States 1980-2003	United Kingdom 1980-2003	Germany 1980-1998	Japan 1980-2003
ρ	0.53 (6.64)	0.57 (7.39)	0.43 (3.93)	0.28 (1.58)
α	-1.72 (-1.13)	-2.59 (-1.43)	0.90 (0.59)	1.08 (1.09)
λ	1.61 (6.11)	0.92 (2.81)	0.83 (4.01)	1.45 (4.19)
μ	0.39 (2.89)	0.57 (1.61)	1.09 (2.46)	-0.29 (-2.15)
ν_1	0.76 (3.53)	0.85 (1.42)	-0.13 (-0.61)	0.16 (0.84)
ν_2		0.65 (1.82)	0.48 (1.92)	
γ_1	-0.11 (-0.40)	-0.13 (-0.48)	0.76 (1.42)	0.51 (2.22)
γ_2	-1.30 (-1.44)	-0.18 (-0.34)	0.35 (0.82)	0.49 (0.64)
γ_3	0.02 (0.29)	-0.11 (-0.99)	-0.12 (-1.59)	-0.03 (-0.48)
$\bar{R}^2$	0.97	0.90	0.94	0.93

NB: Annual data. Newey-West corrected t-stats are given in parenthesis. Least squares estimates.
Source: Author's calculations.

The central Bank gradually adjusts the short-term nominal rate to its target level, which depends on inflation π, the output gap[34] y, the growth rate of GDP $\dot{Y}$ and a foreign short-term nominal rate i^* in some cases. The public expenditure and the *SPS* are simultaneously introduced into the estimate. That makes it possible to test the differentiated effect from expenditures and taxes on the real short rate. Thus γ_1 measures the effect of taxes, $\gamma_2 - \gamma_1$ that of public expenditures, and γ_3 that of the public debt. The effect of fiscal policy on the short-term interest rate implies $\gamma_1 < 0$, $\gamma_2 - \gamma_1 > 0$ and/or $\gamma_3 > 0$. The data set used is described in appendix I. The estimates show that monetary authorities did not increase the short-term interest rate following public expenditure augmentations or taxes falls in each country studied (see table 6). Public debt is insignificant in the four countries.

[34] For the United States, I use the capacities utilization rate in industry.

The real long-term rate

A real long-term interest rate equation is now estimated assuming that this rate is determined by the expected long run equilibrium of demand and supply, current fiscal variables being an indicator of the future fiscal ones. The estimated equation is of the form: $R = \alpha + \mu.y + \gamma_1.SPS + \gamma_2.G + \gamma_3.B + \phi.R^*$. R^* is a foreign real interest rate[35]. Expected inflation follows an adaptive process[36]: $\pi^a_{LT} = 0{,}7.\pi^a_{LT;-1} + 0{,}3.\pi_t$. The output gap y is the gap between GDP and its potential level computed by OECD[37]. The primary balance *SPS* and the primary public expenditure *G* are cyclically-adjusted, and as the public debt *B*, expressed as a % of potential GDP.

Owing to the small sample used and the low power of stationarity tests on small samples, the series are assumed to be stationary. The usual tests can then be applied. The estimates[38] for the 1980-2003 period (see table 7, columns I, V, IX and XIII) only show a negative and significant correlation between the cyclically-adjusted primary balance and the real long rate in the US and English cases. The public expenditure has an impact either negative (for the United States), or nil on the real long rate. Relating to Germany and Japan, the expenditure, debt and public balance coefficients are insignificant. The coefficients of the stock of public debt are not statistically different from zero[39].

Parameters estimate is biased if the estimated equation omits other determinants of the real long rate. However, the small sample size does not allow us to add a lot of additional variables. Two additional variables are included. The portfolio choice model suggests incorporating a measure of bonds holding risk. The bond/equity arbitrage also suggests adding the rate of return on the capital stock (Howe and Pigott, 1991). The equation is then: $R = \alpha + \mu.y + \gamma_1.SPS + \gamma_2.G + \gamma_3.B + \phi.R^* + \delta_1.X + \delta_2.risk_{-1}$. *X* is either the trend growth rate of GDP (columns II, VI, X, and XIV), or the gross rate of return on the private capital stock $rent_k$

[35] For Japan, Germany and the United Kingdom, I use the US real long rate. Significance of γ_1 and γ_2 does not change whereas I include or not foreign real long rates in estimates. Following Artus *and al.* (1990), it is assumed that the US short-term rate is set according to internal factors, unlike other countries' short rates, which depend on the central Banks' exchange rate policy against the US dollar. The US long rate would then be independent of foreign long rates, which would on the contrary depend on the US long rate.

[36] Helbling and Wescott (1995) use a similar expected inflation process, which is abler to replicate non stationarity of inflation series.

[37] I use the capacities utilization rate in industry for the United States.

[38] Estimates are performed on annual data: Correia-Nunes and Stemitsiotis (1995) show that estimates on monthly and quarterly data usually produce no link between interest rates and fiscal variables.

[39] The net debt effect has also been checked and is never significant.

(columns III, VII, XI, and XV), and $risk$ is a measure of the past volatility of the long rate. The new variables do not improve estimates for the United Kingdom and Japan, δ_1 and δ_2 being insignificant or of opposite sign from awaited. In the US case, the trend growth rate has a positive effect on the real long rate. In the German case, taxes have a negative impact with the rate of return on the capital stock in the estimate (column XV).

If only the variables which coefficient is from significant and awaited sign are kept in estimates (see columns IV, VIII, XII, and XVI), the *SPS* has no effect anymore in the United States, unlike in the English case. In the German case, the *SPS* and the gross public debt have a positive and significant effect on the real long rate.

The estimate of a reduced form thus does not allow asserting that fluctuations in public expenditures, deficits and public debt have systematically involved variations in real long rates during 1980-2003. In the United States, a 1 point fall in taxes would involve a 0.25 to 0.5 point augmentation of the real long-term interest rate. But this effect seems to be due to the adding of the public spending in the estimate, which would have a strongly negative (bad signed) effect on the real long rate. For the United Kingdom, a one point fall in the *SPS* would boost the real long rate by 0.22 to 0.42 point, while the debt has no effect. In the German case, the *SPS* increases the real long rate by 0.28 to 0.42 point, and a 1 point rise in the public debt would lead to a 0.05 point rise in the real long rate.

Monetary policy, inflation expectations and the long rate

As expected real long rate equations have been estimated, the monetary policy impact on the long-term rate has been disregarded. The econometric step consists in estimating a model in which the long-term nominal rate I is determined by the short nominal rate i and the expected long run nominal rate. The following equation is estimated:

$$I = \rho.i + (1-\rho).\left(\alpha + \mu.y + \gamma_1.SPS + \gamma_2.G + \gamma_3.B + \phi.R^* + \lambda.\pi_{LT}^a\right)$$

The long run nominal rate depends on fiscal variables[40], expected inflation and, if required, a foreign real long rate. If $\rho = 0; \lambda = 1$, the results of the past section are found again.

Including the short-term rate and estimating the inflation expectations effect greatly improves estimates: standard error estimates are always smaller than in table 7 (see table 8). It confirms the prominent role of monetary policy in long rates determination, except for the

[40] The gross public debt is used for the United States, the United Kingdom and Germany, and the net debt is used for Japan.

German case. Estimates show no effect of debt for all countries (see table 8; columns I, V, IX and XIII), and no impact of fiscal variables for the United States, Japan and Germany (columns I, IX et XIII). For the United Kingdom, a 1 point fall of the *SPS* produces a 0.56 point rise in the real long rate.

Table 7. Real long rate equations estimates

	United States				United Kingdom				Japan				Germany			
	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII***	**XIII**	**XIV**	**XV**	**XVI***
α	4.26	2.43	4.63	3.41	2.85	0.61	6.07	2.85	2.46	2.59	5.92	1.11	4.18	0.94	11.28	1.04
	(32.36)	(1.27)	(3.94)	(20.05)	(23.06)	(0.26)	(7.87)	(20.98)	(22.82)	(2.53)	(2.94)	(4.41)	(40.08)	(0.89)	(4.30)	(1.04)
μ	0.13	0.14	0.12	0.14	0.09	0.07	0.07	0.17	0.12	0.17	0.14	0.14	0.30	0.10	0.24	0.11
	(1.45)	(2.39)	(1.91)	(3.33)	(1.41)	(1.02)	(1.60)	(3.60)	(1.58)	(2.66)	(2.32)	(2.03)	(6.89)	(0.89)	(3.80)	(0.95)
γ_1	-0.51	-0.25	-0.20		-0.28	-0.27	-0.42	-0.22	0.19	0.09	0.27		-0.13	-0.24	-0.42	-0.28
	(-3.83)	(-2.21)	(-1.13)		(-3.90)	(3.67)	(-8.29)	(-4.14)	(1.43)	(0.41)	(2.06)		(-1.00)	(-1.51)	(-2.44)	(-2.09)
γ_2	-1.56	-0.74	-0.78		-0.32	-0.34	-0.45		-0.09	-0.22	0.14		-0.13	0.06	-0.48	
	(-3.08)	(-1.82)	(-1.73)		(-1.38)	(-1.68)	(-4.26)		(-0.22)	(-0.48)	(0.36)		(-1.05)	(0.36)	(-2.66)	
γ_3	0.04	0.00	0.02		-0.04	-0.06	-0.02		0.01	0.01	-0.02		0.01	0.04	0.06	0.05
	(0.72)	(0.08)	(0.64)		(-1.71)	(-2.50)	(-1.32)		(0.38)	(0.33)	(-0.88)		(0.37)	(1.51)	(1.91)	(2.13)
ϕ					0.56	0.40	0.79	0.45	0.23	0.21	0.22		0.17	0.25	0.39	0.23
					(4.93)	(1.82)	(12.54)	(4.35)	(2.90)	(2.76)	(3.19)		(3.37)	(3.14)	(3.18)	(4.85)
δ_1		0.44	-0.03			0.88	-0.19			0.16	-0.14	0.53		1.25	-0.37	1.19
		(0.67)	(-0.78)			(0.89)	(-5.14)			(0.40)	(-1.50)	(5.51)		(2.64)	(-2.93)	(2.76)
δ_2		0.38	0.41	0.73		0.11	-0.36			-1.01	-0.86			0.81	0.17	0.87
		(1.93)	(2.34)	(4.36)		(0.79)	(-1.44)			(-3.86)	(-3.50)			(2.24)	(0.36)	(2.69)
$\bar{R}^2$	0.53	0.63	0.63	0.58	0.71	0.70	0.85	0.69	0.65	0.71	0.71	0.56	0.68	0.82	0.82	0.84
DW	1.70	1.67	1.75	1.33	0.76	0.80	1.56	0.68	1.26	1.18	1.34	0.82	1.24	1.75	1.53	1.73
SEE	0.72	0.64	0.64	0.69	0.70	0.72	0.50	0.73	0.61	0.55	0.55	0.68	0.55	0.41	0.41	0.39

NB: Newey-West corrected t-stats are given in parenthesis. Least squares estimates.
(*): Trend growth in estimate.
Source: Author's calculations

Table 8. Long-term nominal rates, monetary policy and fiscal policy

	United States				United Kingdom				Japan				Germany			
	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate	Fiscal variables	Trend growth	Return on capital	Final estimate
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI***
ρ	0.59 (2.53)	0.54 (4.10)	0.55 (4.07)	0.34 (6.27)	0.42 (3.71)	0.35 (4.48)	0.40 (8.07)	0.36 (9.49)	0.53 (7.71)	0.32 (4.49)	0.40 (5.82)	0.42 (7.39)	0.21 (1.30)	0.03 (0.28)	-0.14 (-1.31)	
α	6.42 (2.05)	2.38 (0.62)	2.04 (0.28)	3.42 (8.10)	0.33 (0.55)	-4.41 (-2.38)	4.06 (2.23)	0.39 (0.69)	-1.78 (-1.37)	-3.44 (-3.99)	-8.24 (-2.07)	0.09 (0.12)	5.72 (4.76)	-1.48 (-1.00)	12.62 (6.31)	-1.33 (-0.85)
μ	-0.24 (-0.59)	-0.14 (-0.72)	-0.14 (-0.70)		-0.07 (-0.63)	-0.14 (-1.85)	-0.22 (-2.91)		-0.31 (-2.10)	-0.23 (-2.82)	-0.38 (-3.08)	0.16 (2.59)	0.10 (0.58)	0.09 (0.78)	0.36 (5.15)	0.10 (0.94)
γ_1	-1.01 (-1.31)	-0.41 (-1.34)	-0.54 (-1.24)		-0.56 (-6.55)	-0.63 (-9.33)	-0.61 (-9.35)	-0.46 (-10.73)	0.05 (0.31)	0.06 (0.57)	0.21 (1.61)		-0.18 (-0.65)	-0.38 (-3.03)	-0.56 (-3.63)	-0.29 (-2.43)
γ_2	-1.82 (-1.53)	-0.15 (-0.18)	-0.54 (-0.63)		-0.04 (-0.14)	-0.17 (-1.21)	-0.17 (-1.47)		0.03 (0.11)	0.57 (3.33)	0.35 (1.37)		-0.07 (-0.17)	-0.13 (-0.71)	-0.81 (-3.33)	
γ_3	0.19 (1.06)	0.09 (1.00)	0.15 (1.40)	0.05 (2.72)	0.04 (0.93)	0.01 (0.25)	0.06 (2.05)		-0.07 (-2.76)	-0.10 (-6.24)	-0.10 (-3.84)		0.00 (0.06)	0.12 (3.27)	0.11 (2.84)	0.09 (2.93)
ϕ					0.97 (5.10)	1.07 (6.28)	1.14 (8.51)	0.92 (6.40)	1.03 (3.99)	0.64 (4.65)	0.81 (4.34)	0.61 (4.34)	0.23 (2.17)	0.25 (3.31)	0.43 (4.82)	0.29 (5.39)
λ	1.14 (3.49)	1.11 (4.82)	1.34 (2.39)	1.24 (10.72)	1.15 (19.58)	1.37 (24.29)	1.04 (9.12)	1.15 (21.30)	0.68 (4.20)	0.87 (8.97)	0.79 (5.78)	0.76 (7.63)	0.57 (1.56)	1.44 (7.55)	1.49 (7.41)	1.39 (7.09)
δ_1		0.88 (0.58)	0.08 (0.40)			1.52 (2.08)	-0.19 (-2.73)			1.42 (4.24)	0.35 (1.87)			1.77 (3.71)	-0.52 (-4.72)	1.77 (3.74)
δ_2		0.76 (2.13)	0.93 (2.38)	0.75 (3.63)		-0.74 (-4.25)	-0.78 (-4.71)			-1.39 (-5.11)	-1.37 (-3.22)			0.74 (1.82)	-0.09 (-0.24)	0.67 (1.85)
$\bar{R}^2$	0.94	0.96	0.96	0.96	0.98	0.99	0.99	0.98	0.98	0.99	0.98	0.96	0.83	0.91	0.91	0.92
DW	1.97	1.96	1.74	1.55	1.86	1.99	2.12	1.61	1.97	2.16	2.22	0.99	1.07	1.93	2.05	2.00
SEE	0.65	0.56	0.57	0.55	0.42	0.29	0.28	0.41	0.38	0.30	0.34	0.48	0.54	0.41	0.41	0.37

NB: Newey-West corrected t-stats are given in parenthesis. Non linear least squares estimates.
(*): Trend growth in estimate. *Source*: Author's calculations

Including additional variables confirms results for the United States and the United Kingdom. In the latter country, debt has a positive effect, but the risk premium and the return on capital have a negative impact, unlike what is expected. For Japan, a positive effect of public spending is reported (column X) whereas the coefficient for the risk premium is negative. In the German case (columns XIV and XV), the trend growth has a significant and of expected sign coefficient, and the risk premium is significant at the 10% level. The public surplus has now a negative effect on the interest rate, of -0.38 point for a 1-percent-of-potential-GDP change in the *SPS*. A 1-percent-of-potential-GDP change in the public debt also has an effect of 0.12 point on the interest rate.

Keeping the variables which coefficient is from significant and awaited sign in estimates (columns IV, VIII, XII and XVI) involves that now fiscal policy has no effect in Japan. The *SPS* has a negative effect in Germany and the United Kingdom, and the public debt has a significant effect in Germany and the United States.

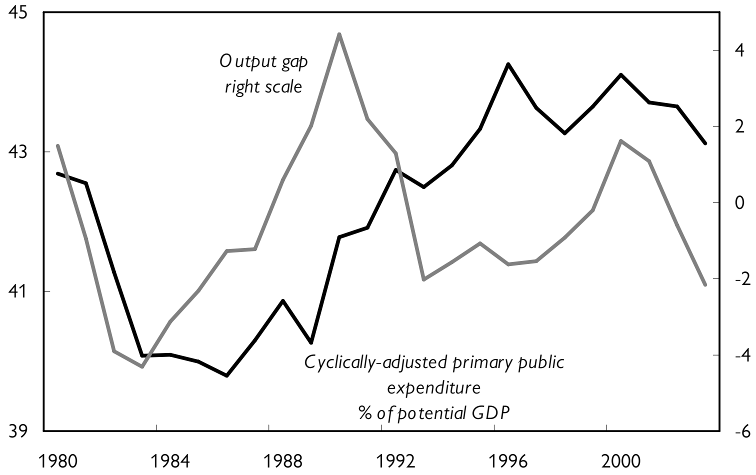
The cyclically-adjusted primary public spending and primary balance, as well as the public debt have no effect on the Japanese long-term interest rate in the 1980-2003 period. The deflation in Japan throughout the Nineties implies that this country was not on average in Classical regime during that period. The big rises in public expenditures and debt were not related to a strong aggregate demand, which resulted in insignificant effects on the real long rate.

In Germany, results are more difficult to clarify. Results (tables 7 and 8) show that a one point decrease in the *SPS* raises the real long rate by 0.28 to 0.38 point, and a one point increase in the debt raises the long rate by 0.05 to 0.09 point. The procyclical nature of the fiscal policy (see chart 4) especially because of the German reunification, and the strong commitment of the Bundesbank to fight against inflation could have created tensions between the monetary and fiscal authorities, which would have been reflected in long-term interest rates. However, the primary structural public spending level has been high throughout the nineties, whereas the output gap was continuously negative between 1993 and 1998 (and the unemployment rate was high). It is then hard to conclude that those effects were crowding-out ones, unless assuming that markets expected a fast convergence to full-employment and a sluggish deficit.

Relating to the United Kingdom, a first conclusion would be that a permanent 1 point fall in the *SPS* would trigger the real long rate to increase by 0.22 to 0.46 point. Such a statement assumes that over the 1980-2003 period, fiscal policies were on average procyclical, or else that a climb (or a reduction) in the public expenditure and/or public debt led to a permanent change of the real long-term interest rate. However, data do not support such a fact (see charts 1, 2 and 3). Public expenditures are stable on average during the period, and the *SPS* is countercyclical. A one point increase in the output gap is correlated with a fall of the public spending of 0.34 point (see chart 4). Moreover, debt plummets, without any effect on the long rate. The assessed effect could then either come from expectations related to the *SPS* sluggishness, or from bad business cycle effects estimation.

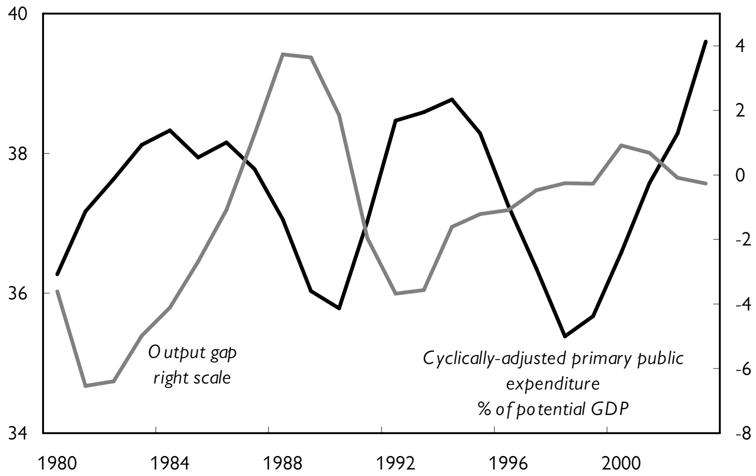
In the United States, fiscal policy effects on the real interest rate seem not to be robust to the specification used. Only a debt effect is found when non significant variables are removed from estimates (table 8). The assessed effect is of the same importance than those found by Laubach (2003) or Gale and Orszag (2004). That result also runs counter to numerous studies that find a positive link between the public deficit and interest rates for that country. It shows the importance of fiscal variables selection in assessing their effects on interest rates. Of course, the small sample used implies to be careful when interpreting the results.

4a. Public spending and output gap; Germany



Sources: OECD Economic Outlook 76.

4b. Public spending and output gap; United-Kingdom



Sources: OECD Economic Outlook 76.

Conclusion

This study has dealt with fiscal policy effects on interest rates. Estimates show that fiscal policy has no *mechanical* effect on interest rates. Its effects depend on the policy-mix, and on the economy's regime. Furthermore, distinguishing between short run and crowding-out effects remains a difficult task in practice.

From a theoretical point of view, neither the determination and accumulation of the private capital stock, nor international financial and trade exchanges have been taken into account, which are clear limits of that work. Empirically, private non-financial debt and asset holding behaviours have not been included. The fiscal policy effects on private long-term interest rates should also be directly assessed. All these comments will give rise to additional work in the future.

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Appendix I: Data description

GDP, output gaps, gross and net debts, cyclically-adjusted primary balances and public expenditures come from the OECD Economic Outlook Database. Debt series are computed for year *t* as the end-of-years *t* and *t-1* average, and are then divided by nominal (current or potential) GDP of year *t*.

Series of the return on private capital stock are computed in % as $rent_k = \frac{GOS}{K * P_{GFCF}}$. GOS is the gross operating surplus (source: OECD Annual National Accounts), K is the private non-residential capital stock in volume (*source*: OECD Economic Outlook n°76) and P_{GFCF} is the private non-financial gross fixed capital formation deflator (*source*: OECD Economic Outlook n° 76).

The trend growth rate of GDP is the trend of the annual growth rate of GDP in volume computed with an HP filter (lambda=40). In order to avoid a jump on the German series due to the reunification, I have taken the annual growth rate of West Germany’s GDP until 1991, and the annual growth rate of Reunified Germany’s GDP thereafter (*sources*: GlobalInsight, Bundesbank). *risk* is computed as the 12-quarter moving variance of the nominal long-term rate.

United States. Inflation is computed from the GDP price index (*source*: OECD Economic Outlook Database). The short-term interest rate is a 3-month Treasury bill rate, and the long-term rate is a constant, fixed maturity 10-year yield on Treasury securities (*source*: US Federal Reserve). The total production capacities utilization rate comes from Global Insight (*source*: US Federal Reserve). A gross public debt in % of current GDP has also been computed. It is the sum of the Central Government and the States and Local Administrations debts (*source*: Flow of Funds).

United Kingdom. Inflation is computed from the Retail Price Index, chained with the growth rate of the RPIX from November of 1992 (*source*: Office of National Statistics). The short-term rate is a 3 month Treasury bill rate (*source*: Bank of England) and the long-term rate comes from the OECD Main Economic Indicators Database. A gross public debt in % of current GDP that comes from the United Kingdom Economic Accounts has also been computed. It is the ‘net financial liabilities’ series *NPVQ*. That series is used in the reaction function estimate.

Germany. Inflation is computed from the West Germany’s Consumer Price Index until 1991, and then from the Unified Germany’s Consumer Price Index (*source*: Global Insight, Bundesbank). The short-term rate is the 3-month FIBOR, and the long-term rate is a yield on 9-to-10-year Federal Securities (*sources*: Datastream).

Japan. Inflation is computed from the Retail Price Index (*sources*: Datastream, Ministry of Public Management, Home Affairs, Posts and Telecom). The short-term rate is an average of the uncollateralized overnight call rate (*source*: Bank of Japan), and the long-term rate is a 10-year yield on public securities (*source*: Datastream).

Appendix II: Correia Nunes and Stemitsiotis' 1995 paper

Data used by Correia Nunes and Stemitsiotis in their 1995 paper have been re-built. Data come from the EC (European Commission) (public balance, nominal and real GDP; Germany, France, United Kingdom, Belgium, Denmark, Ireland, Netherlands), OECD (public balance, nominal and real GDP; United States, Japan, Canada), and from IFS (International Financial Statistics) database of IMF (consumer price index, nominal short and long rates).

EC's data were built on the old concept of public balance, before ESA95 format. Data is available for the 1970-1995 period[1] (1971-1995 for Denmark). A first limit of their work is that they use these data to build aggregated data used as lagged instrument in estimates (in order to take account of international financial markets integration). The estimate reported here is thus done on the 1971-1993 period.

Authors build an expected inflation series for each country, by filtering the consumer price index annual growth series with an HP filter. They do not mention the smoothing parameter value, which has been set to 100 by convention. Moreover, the authors do not explain how they compute the real short-term rate: is it by using the annual growth rate of the consumer price index or the computed expected inflation series? The second solution has been retained.

The authors estimate the equation: $I = \alpha_0 + \alpha_1.r + \alpha_2.\pi^a + \alpha_3.\dot{Y} + \varphi_1.def$. r is the short-term real rate, π^a is the expected inflation rate, *def* the public deficit, and $\dot{Y}$ is the growth rate of GDP. They use the 2S2SLS estimator (Two Steps Two Stages Least Squares) and compute the covariance matrix of residuals with the Hansen method[2], taking account of order 1 autocorrelation in residuals. One-step estimation of the same equation is done with order-1-corrected GMM estimator, with RATS 6.0.

The estimate effect of deficit by Correia Nunes and Stemitsiotis (CN&S in table A1) is compared to the one obtained with rebuilt data. Coefficients estimates are very different in six cases out of ten (France, United Kingdom, Canada, Belgium, Denmark and Ireland). In five cases, coefficients of the new estimate are not statistically significantly different from zero

[1] EC's data built on the old concept of deficit are available for the 1970-1995 period. Public deficit series in ESA95 format are not available for a long period of time in the AMECO 2003 database.

[2] That method is very close to the GMM estimator (Generalized Method of Moments). See Cumby *and al.* (1983) for a demonstration of the link between the two estimators.

(Germany, France, Belgium, Denmark and Ireland), and they are smaller than CN&S estimates in seven cases out of ten. T-stats and $\bar{R}^2$ are always smaller than those of CN&S. Finally, the Durbin-Watson stat (not reported in table A1) shows high presumption of autocorrelation in residuals for France, Germany, Denmark and Canada.

Table A1. Estimates of Correia Nunes and Stemitsiotis (1995) equation on 1971-1993

	φ_1		$\bar{R}^2$	
	CN&S	New estimation	CN&S	New estimation
United States	0.79 (9.47)	0.74 (8.59)	0.93	0.92
Japan	0.21 (9.14)	0.26 (2.26)	0.90	0.80
Germany	0.22 (3.22)	0.27 (1.70)	0.84	0.55
France	0.54 (6.40)	0.16 (0.47)	0.92	0.79
United Kingdom	0.32 (5.97)	0.47 (2.56)	0.91	0.75
Canada	0.53 (6.62)	0.21 (2.61)	0.89	0.85
Belgium	0.35 (6.98)	0.22 (1.51)	0.90	0.79
Denmark	0.34 (2.80)	0.09 (0.59)	0.89	0.70
Ireland	0.22 (4.46)	-0.02 (-0.02)	0.90	0.71
Netherlands	0.50 (14.90)	0.46 (3.31)	0.89	0.74

NB : *t*-stats in parenthesis ; GMM estimates.
Source: OECD Economic Outlook, European Commission AMECO 2003, *General Government Data Part II* (Spring 2003), *International Financial Statistics*, author's estmates.